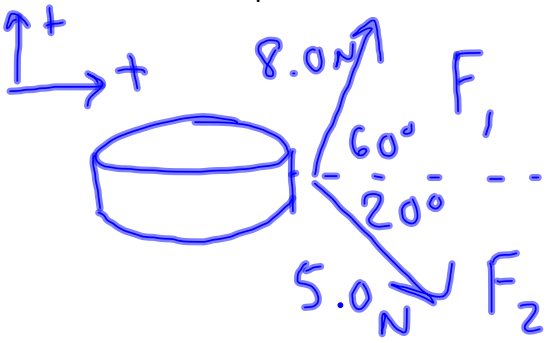
Force Practice Problems and Notes 9.15.11

A hockey puck having a mass of 0.30 kg slides on the horizontal, frictionless surface of an ice rink. Two hockey sticks strike the puck simultaneously, each exerting a force. The first stick's force is 5.0 N at 20 degrees south of east, and the second stick's force is 8.0 N at 60 degrees north of east. Determine both the magnitude and the direction of the puck's acceleration.

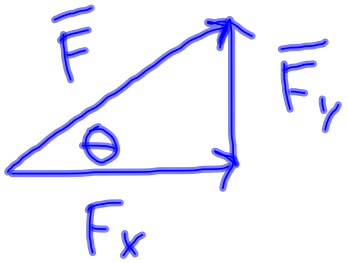


$$\Sigma \bar{F} = m\bar{a}$$

$$F_{1x} = F_1 \cos(60°) \qquad F_{1y} = F_1 \sin(60°)$$

$$+F_{2x} = F_2 \cos(20°) \qquad +F_{2y} = F_2 \sin(20°)$$

$$F_x = 8.63\ N \qquad F_y = 5.22\ N$$



$$\bar{F} = 10.2\ N\ @\ 31°\ N\ of\ E$$

$$\bar{a} = 34.0\ m/s^2\ @\ 31°\ N\ of\ E$$

$$\Sigma F = ma$$

$$a = \frac{\Sigma F}{m} = \frac{10.2\ N}{.30\ kg} = 34.0\ m/s^2$$

General Notes:

- Direction of net force and acceleration are the same
- Units for Force are newtons (N).

$$1\ N = 1\ \frac{kg \cdot m}{s^2}$$

- To calculate weight:

$$F_g = ma_g$$

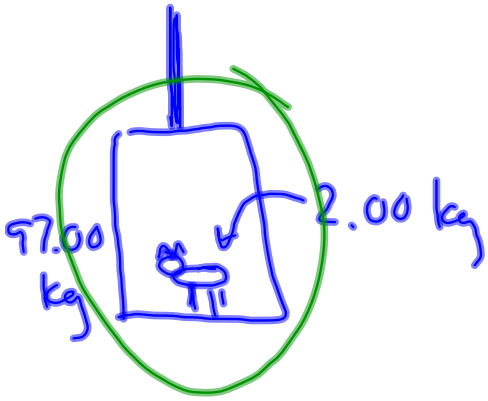
- Another force:

Tension

- happens in strings
- string is massless and doesn't stretch

- Plug in $9.8\ m/s^2$ for a_g. Take care of negative when doing sum of forces.

A 2.00 kg cat is in a 97.00 kg elevator. What force on the elevator cable would be needed to raise the cat/elevator pair upwards with a constant velocity?



↑+ FBD:

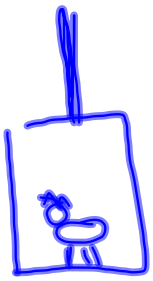
$$\Sigma F_y = 0$$

$$+F_T + (-F_g) = 0$$

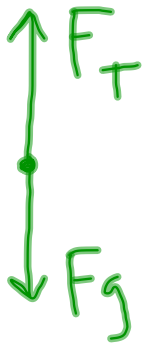
$$F_T = F_g = ma_g = (97\,kg + 2\,kg)(9.8\,m/s^2)$$

$$= 970\,N$$

A 2.00 kg cat is in a 97.00 kg elevator. What force on the elevator cable would be needed to raise the cat/elevator pair upwards with an acceleration of 2.00 m/s/s upwards?



$\uparrow +$ FBD:



$a = +2.00\ m/s^2$

$$\Sigma \vec{F} = m\vec{a}$$

$$F_T + (-F_g) = ma$$

$$F_T = F_g + ma = ma_g + ma$$

$$= m(a_g + a)$$

$$= (99\,kg)(9.8\ m/s^2 + 2.00\ m/s^2)$$

$$= 1168\ N$$